

Applicant : Yong MA
Appl. No. : 10/077,522
Examiner : Cornelius Jackson
Docket No. : 703683.3 (formerly 270/205)

REMARKS

Claims 1-22 are pending in the application. Applicant respectfully requests reconsideration in view of the following remarks.

Claim Rejections under 35 U.S.C. § 102

The Examiner rejected claims under 35 U.S.C. § 102(e) as being anticipated by Grubb et al. (6344925). Applicant respectfully request reconsideration of this rejection.

Claim 1 is not anticipated by Grubb because Grubb fails to disclose a resonator formed of electro-optic material and having an adjustable refractive index induced tunable resonance wavelength, and first and second waveguide optically coupled through evanescent wave coupling.

Contrary to the Examiner's assertion, Grubb does not disclose a resonator formed of an electro-optic material. Instead, the resonator of Grubb is made of optical fiber or other Ramen gain medium (see column 7, lines 41-49). The sections of Grubb cited by the Examiner (i.e., col. 3, lines 23-26, col. 4, line 61 - col. 5, line 15, col. 6, lines 27-35 and col. 7, line 50 - col. 8, line 2) make no reference to a resonator being formed of electro-optic material. In fact, the word "electro-optic" appears nowhere in Grubb, much less in the sections cited by the Examiner. If the Examiner still maintains that Grubb discloses a resonator formed of electro-optic material, the Applicant respectfully requests that the Examiner particularly point out how Grubb discloses a resonator formed of electro-optic material, rather than merely citing sections of Grubb.

In addition, Grubb does not disclose a resonator having an adjustable refractive index induced tunable resonance wavelength. The sections of Grubb cited by the Examiner (i.e., col. 3, lines 23-26, col. 4, line 61 - col. 5, line 15, col. 6, lines 27-35 and col. 7, line 50 - col. 8, line 2)

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make no reference to tuning the resonance wavelength of the cascaded Ramen resonator (CRR), much less refractive index induced tuning of the resonance wavelength. In fact, the words “refractive index” appear nowhere in Grubb. If the Examiner still maintains that Grubb discloses a resonator having an adjustable refractive index induced tunable resonance wavelength, the Applicant respectfully requests that the Examiner particularly point out how Grubb discloses a resonator having an adjustable refractive index induced tunable resonance wavelength, rather than merely citing sections of Grubb.

Still more, Grubb does not disclose evanescent wave coupling. Instead, the coupling in Grubb is accomplished with WDM couplers. The sections of Grubb cited by the Examiner (i.e., col. 3, lines 23-26, col. 4, line 61 - col. 5, line 15, col. 6, lines 27-35 and col. 7, line 50 - col. 8, line 2) make no reference to evanescent wave coupling. In fact, the word “evanescent” appears nowhere in Grubb. If the Examiner still maintains that Grubb discloses evanescent wave coupling, the Applicant respectfully requests that the Examiner particularly point out how Grubb discloses evanescent wave coupling, rather than merely citing sections of Grubb.

Because Grubb fails to disclose a resonator formed of electro-optic material and having an adjustable refractive index induced tunable resonance wavelength, and first and second waveguide optically coupled through evanescent wave coupling, claim 1 is not anticipated by Grubb and is therefore patentable over Grubb.

Claim Rejections under 35 U.S.C. § 103

The Examiner rejected claims under 35 U.S.C. § 103(a) as obvious over Grubb et al. (6344925) in view of Ho (6009115). Applicant respectfully request reconsideration of this rejection.

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Claim 1 is also not rendered obvious by the combined teachings of Grubb and Ho (6009115). Grubb discloses a cascaded Ramen resonator (CRR) comprising input and output WDM couplers 46_i and 46_o and a fiber Ramen ring 48, made of optical fiber or other Ramen gain medium, interconnecting the WDM couplers 46_i and 46_o (see FIG. 6 and column 7, lines 32-49 of Grubb). The fiber ring 48 provides Ramen gain and stoke wavelength shifting, which is essential for the function of a CRR. Ho discloses a semiconductor micro-resonator device 10 comprising a microcavity resonator 12 and a pair of waveguides 14 and 16 (see FIG. 1 and column 3, line 66 to column 4, line 1 of Ho).

Ho's microcavity resonator 12 differs from Grubb's fiber ring 48 in that Ho's microcavity resonator 12 is formed of semiconductor material instead of optical fiber or other Ramen gain medium (see column 4, lines 62-65). Because Ho's microcavity resonator 12 is semiconductor-based, one skilled in the art would not think to replace Grubb's fiber ring 48 with Ho's microcavity resonator 12 to come up with the tunable laser of claim 1. For one reason, semiconductors have much higher optical loss than Ramen gain fibers. As a result, Ho's microcavity resonator 12 would require a much higher pump power to realize the same Ramen gain as Grubb's fiber ring 48. Another reason is that fiber rings in CRRs are typically required to be meters to kilometers in diameter in order to achieve enough Ramen gain. Realizing such a large diameter with a semiconductor-based resonator, such as Ho's microcavity resonator 12, is not feasible.

Further, in semiconductor material, Raman gain mostly occurs at specific well-defined frequencies because of their crystalline nature in which the molecular vibrational frequencies have very narrow bandwidth. Thus, even if one could make a CRR out of semiconductor

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materials, it won't be tunable because it can only provide Raman gain at a specific frequency.

As a practical point, there is no CRR made out of semiconductor materials.

Because claim 1 is not rendered obvious by the combined teachings of Grubb and Ho, claim 1 is patentable over their combination.

Claims 2 through 22 all depend from claim 1 and are therefore patentable for at least the reasons given above for claim 1.

Furthermore, contrary to the Examiner's assertion with respect to claim 3, it would not have been obvious one skilled in the art in view of Ho to place all the elements of Grubb on a single substrate to keep the arrangement constants and to form an on-chip integration with other semiconductor devices. To establish a *prima facie* case of obviousness, there must be a reasonable expectation of success. See MPEP § 2143. Here, there would have been no reasonable expectation of success that the CRR of Grubb could be integrated on a chip with other semiconductor devices. To begin with, Grubb discloses that the CRR is made of optical fiber or other Raman gain medium and not semiconductor material (see column 7, lines 41-49). Neither Grubb nor Ho teaches one skilled in the art how to integrate optical fiber or other Raman gain medium on a chip with semiconductor devices. In addition, CRRs are typically required to be meters or kilometers in diameter in order to achieve enough Raman gain. For example, Grubb discloses on col. 7, lines 12-15 that suitable CRRs are described in U.S. Patent No. 5,323,404, which discloses cavity lengths on the order of 300 m to about 3 km (see col. 5, lines 39-43 of Patent No. 5,323,404). Integrating such large structures on a chip with semiconductor devices is simply not feasible. Therefore, claim 3 is not only patentable because of its dependence from claim 1, but is also patentable because there would have been no reasonable expectation of success that the CRR of Grubb could be integrated on a chip with other semiconductor devices.

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Conclusion

It is believed that the Application is now in condition for allowance and a favorable action is respectfully solicited.

Respectfully submitted,

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Dated: August 25, 2004

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